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FOREST PEST MANAGEMENT

3430 BIOLOGICAL EVALUATION
R2-83-3

MOUNTAIN PINE BEETLE
SHIRLEY MOUNTAINS, WYOMING

1982

United States
Department of
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Forest Pest Management
Denver, Colorado

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INTRODUCTION

Mountain pine beetle (MPB), *Dendroctonus ponderosae* Hopkins, in epidemic populations can kill over 50% of a lodgepole pine stand (*Pinus contorta* Loudon), initially taking out the larger, merchantable and more esthetic trees.

Mountain pine beetle was mapped on the Shirley Mountains of Wyoming (about 55 miles southwest of Casper) by Forest Pest Management Staff during aerial surveys in 1980-82 (Figures 1 and 2). Approximately 2500 fading trees were counted in 1982. With the MPB population showing up at these levels, the stands may have reached optimum conditions for supporting an epidemic MPB population. Stage II stand data collected by Bureau of Land Management (BLM) (Appendix I) on Compartment 1 was evaluated against a risk rating scheme by Amman, et al. (1977) to determine the percent of the lodgepole stand the landowners can expect to lose to MPB within the next few years. In this evaluation, management practices to reduce losses due to MPB are discussed together with dwarf mistletoe suppression.

BIOLOGICAL INFORMATION

The mountain pine beetle has a one year life cycle throughout most of Region 2; at high elevations the beetle may take up to two years to complete its life cycle.

Eggs are laid in August and September, hatching into larvae within a few days. Diapause sets in with freezing weather during the first and second instars. Feeding resumes the following May. The pupal stage occurs around June and adults emerge at the end of July. The adult beetle flight period may last from mid July through September.

Dwarf mistletoe (*Arceuthobium americanum* Nutt. ex Engelm) is a parasitic plant. The visible green leaflets main function is reproduction and some production of food materials. The food gathering portion of the plant consists of strands below the bark. These strands absorb food from the surrounding tissue causing growth reduction and mortality of its host over several years.

Seed dispersal is confined to late summer and early fall. Seeds are forcibly launched from the mature berries on the plant and adhere to an object. Seeds that land on lodgepole pines send strands into the bark. Buds appear in several years. Half of the plants are capable of producing seed. It takes 16 months after pollination for a plant to produce fruit. The entire life cycle takes 4-6 years depending on conditions.

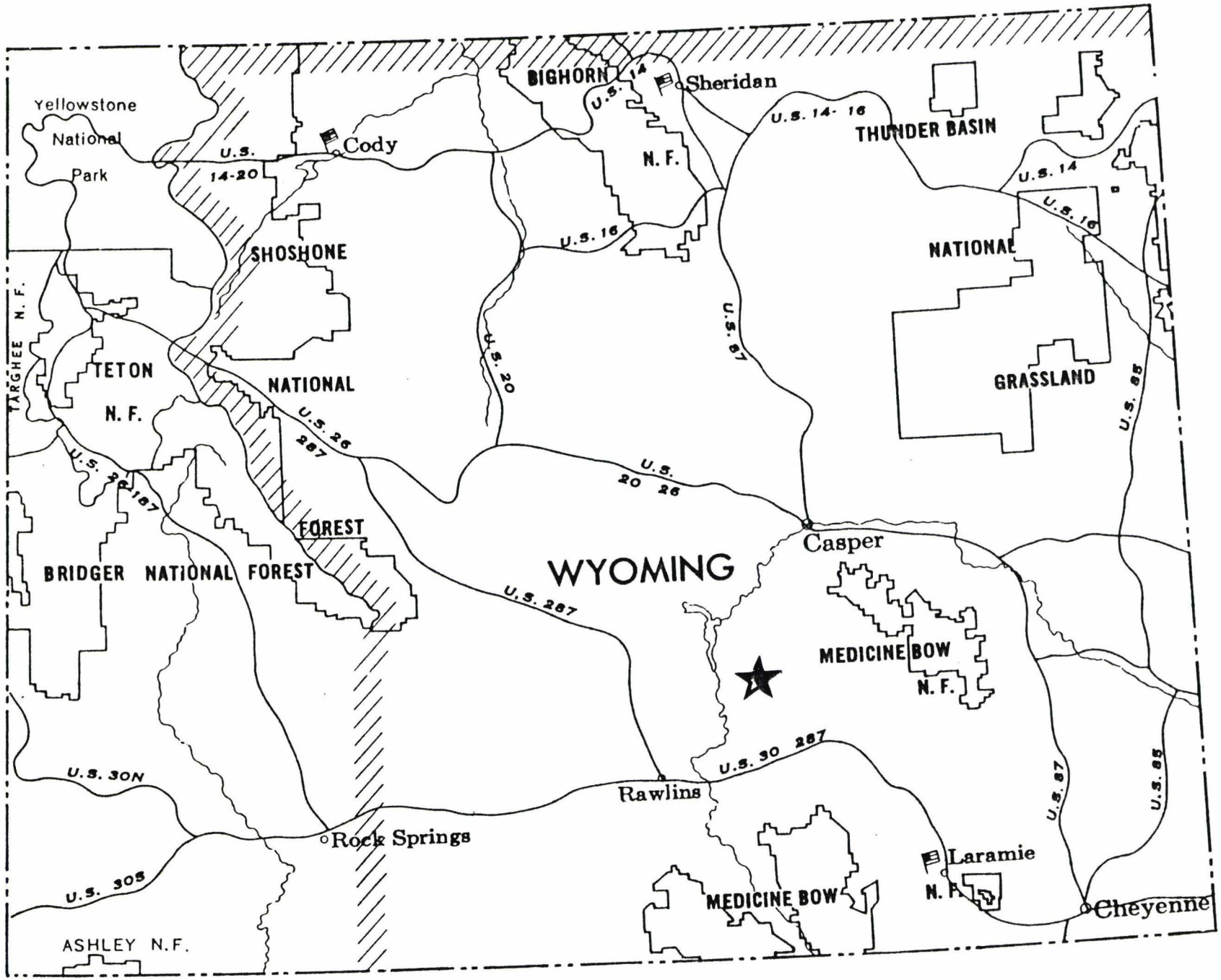

FIGURE 1.

★ LOCATION OF THE SHIRLEY MOUNTAINS, WYOMING.

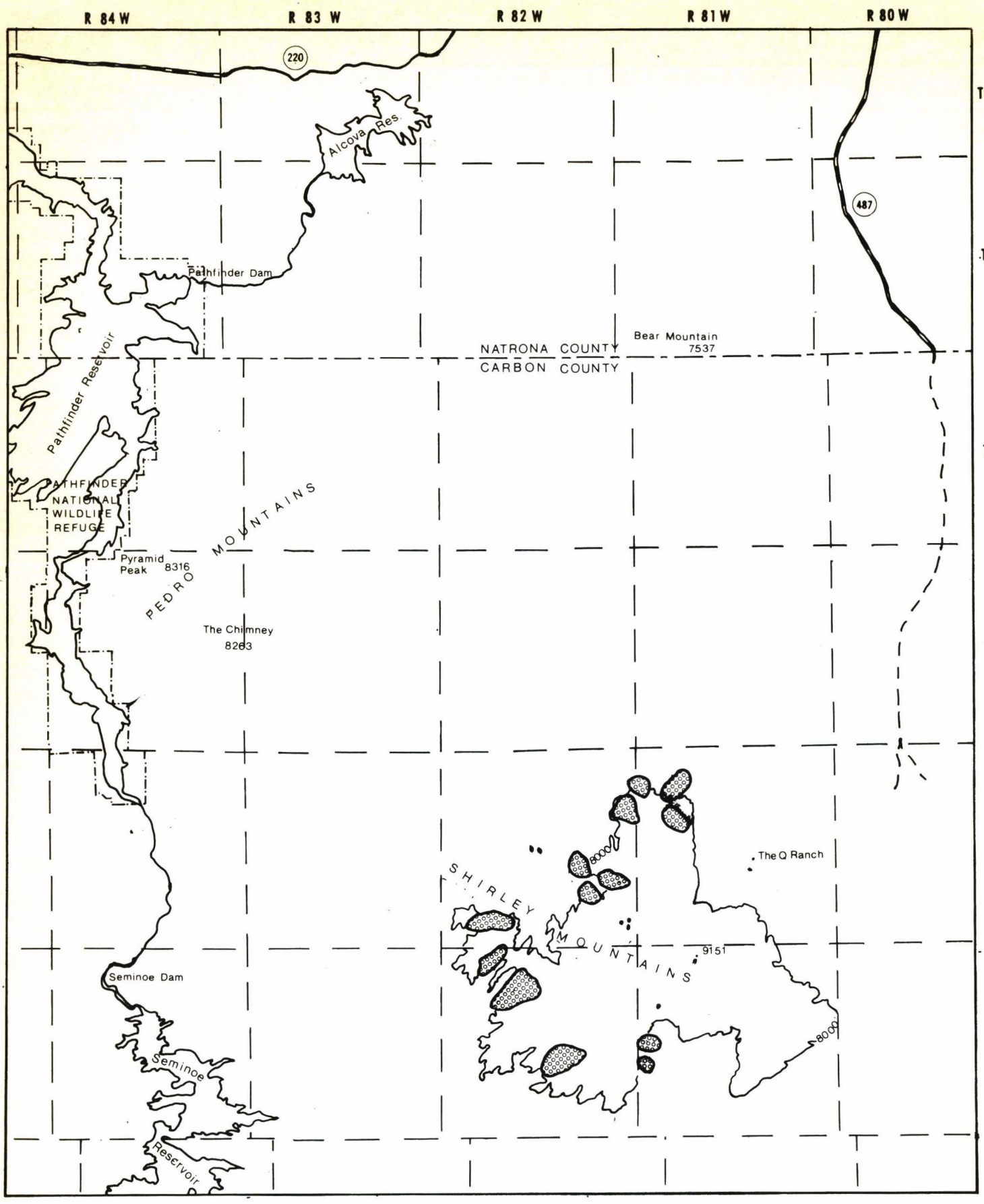

FIG.2--Distribution of mountain pine beetle on the Shirley Mountains, Wyoming, 1982.

METHODS

Stage II data collected by BLM was used to determine the overall susceptibility of lodgepole pine stands to MPB utilizing the three stand parameters established by Amman, et al. (1977). The first stand parameter considered was to determine zone risk factors on the basis of stand location by latitude and elevation (Figure 3). The second and third stand parameters are average stand age and diameter. Risk factors for age are: below 60 years, low risk; between 60 and 80 years, moderate risk; and over 80 years, high risk. Risk factors for diameter are: low risk, under 7 inches; moderate risk, between 7 and 8 inches; high risk, over 8 inches. Each stand parameter is then assigned a numerical risk factor of low = 1; moderate = 2; high = 3 (Table 1).

Table 1. 1/ Numerical rating of stand parameter.

Elevation-latitude	Risk Factor	Average Age (years)	Risk Factor	Average d.b.h. (inches)	Risk Factor
High (8000')	(1)	60	(1)	<7	(1)
Moderate (8000' - 9000')	(2)	60-80	(2)	7-8	(2)
Low (9000')	(3)	>80	(3)	>8	(3)

To find the overall stand susceptibility rating, the rating numbers for elevation and latitude, average stand age and average stand diameter are multiplied. The dwarf mistletoe rating from the Stage II data was employed to project dwarf mistletoe infection in the stands at rotation age, using the RMYLD program published by Edminster (1978).

RESULTS AND DISCUSSION

The susceptibility ratings of the stands in Compartment 1 on the Shirley Mountains are in Table 2. All stands in Compartment 1 lie in the moderate risk elevational category (42° latitude), eliminating the possibility of an overall high risk rating for any of the stands. Four stands have an average age over 80 years and an average diameter over eight inches. Both factors are considered high risk. Five additional stands have an average age over 80 years and an average diameter over seven inches, which is moderate risk.

1/ Amman et al. 1977. Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in unmanaged stands in the Rocky Mountains.

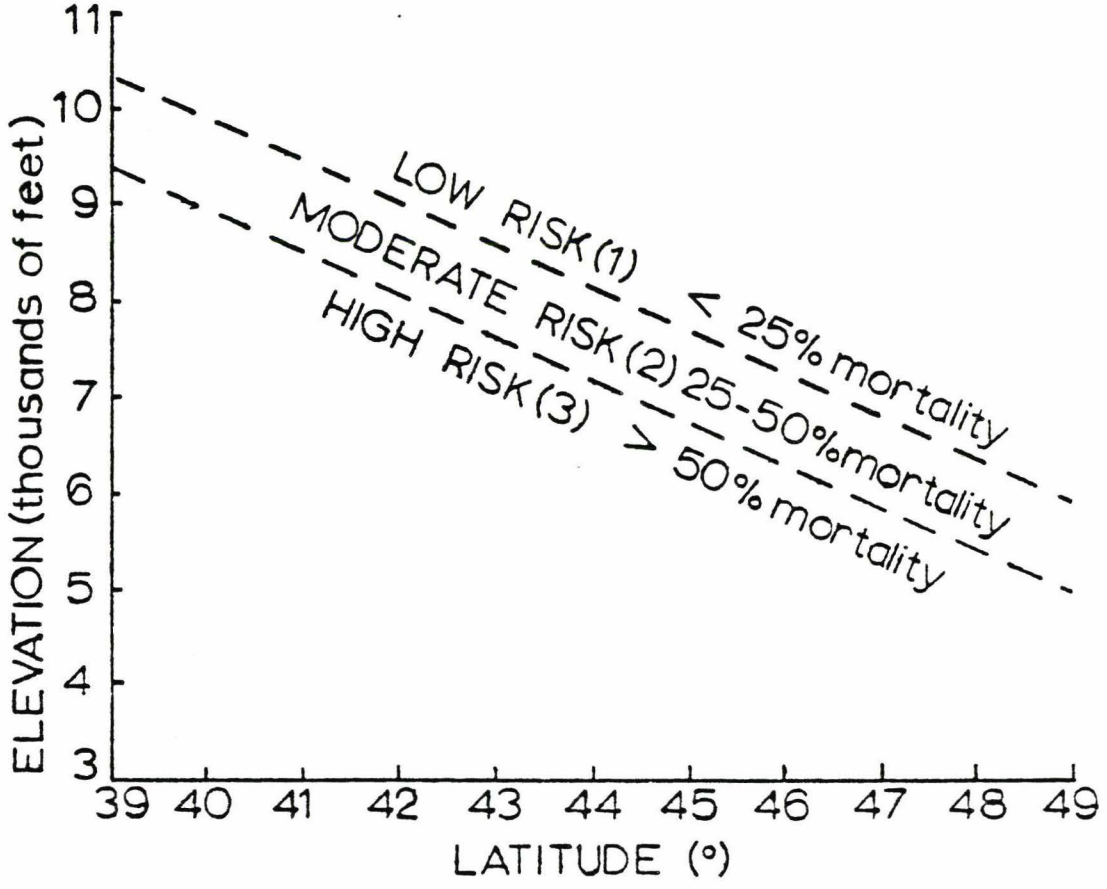

Figure 3. Risk of mountain pine beetle infestation in lodgepole pine can be defined by zones of elevation and latitude. Percent mortality is for trees 8.5 inches d.b.h. and larger. *

* Amman et al. 1977. Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in unmanaged stands in the Rocky Mountains.

Table 2. Susceptibility ratings of stands in Compartment 1

Stand	42° Latitude at Elevation	Risk Factor	Average d.b.h.	Risk Factor	Age	Risk Factor	Stand Susceptibility Rating
1	8600	2	7.6	2	100	3	12 - Moderate
2	8700	2	3.0	1	64	2	4 - Low
3	8550	2	7.1	2	103	3	12 - Moderate
4	8550	2	8.2	3	68	2	12 - Moderate
7	8400	2	9.1	3	95	3	18 - Moderate
10	8550	2	8.1	3	91	3	18 - Moderate
11	8550	2	8.9	3	87	3	18 - Moderate
15	8600	2	7.5	2	60	2	8 - Low
18	8500	2	7.8	2	89	3	12 - Moderate
20	8450	2	7.0	2	62	2	8 - Low
21	8400	2	6.9	1	66	2	4 - Low
22	8350	2	8.2	3	98	3	18 - Moderate
23	8400	2	7.0	2	67	2	8 - Low
24	8500	2	8.0	2	103	3	12 - Moderate
30	?	2	7.7	2	95	3	12 - Moderate
33	?	2	5.8	1	61	2	4 - Low
39	8400	2	7.4	2	64	2	8 - Low

These stands would sustain a MPB infestation and a loss of up to 50% of the stocking. Within twenty years, the one remaining moderate risk stand and seven low risk stands will have reached 80 years of age and will be susceptible to the same amount of loss as the older moderate risk stands.

Dwarf mistletoe is present in 13 of the 17 stands (Appendix II). Dwarf mistletoe reduces tree growth and vigor. Weakened trees are more susceptible to beetle attack. Dwarf mistletoe control should be included in management plans to improve the general vigor of the existing and future stands.

Mountain pine beetle and dwarf mistletoe control can be accomplished through normal cutting practices. Intermediate cuts should concentrate on reducing average stand age and average stand diameter to below high risk levels for mountain pine beetle. The inclusion of MPB infested trees in these cuts would be for salvage purposes rather than for suppression. Losses are consistent for each risk class whether suppression tactics are or are not used. However, present and future reduction of dwarf mistletoe infection in a stand is accomplished by direct removal of infected overstory trees. Long range MPB control practices should include attempts to break up stand age and diameter classes to confine future outbreaks to small areas.

Five alternatives to be considered in a management plan:

1. No management
2. Thinning
3. Thinning from above
4. Patch clearcuts
5. Large clearcuts (20-40 acres)

1. No management - The no management alternative would result in MPB causing up to 50% mortality in moderate risk stands. Dwarf mistletoe will continue to intensify and spread causing growth reduction and eventually tree mortality. The standing dead trees would become nesting sites for some birds and small animals. As dead trees fall they provide cover for larger animals and squirrels The openings created by the dead trees become covered with shrubs used by browsing wildlife (Amman et al. 1977). MPB acts as a natural thinning agent. It diversifies diameter and age classes in a stand. The new uneven-age stand would support only spotty outbreaks of MPB.

Two problems arise if the infested or dead trees are not removed. First, the stand may become a source of beetles that may attack adjacent commercial forest land. And second, the trees killed by mountain pine beetle increases the fuel load and increased possibility for a wildfire.

2. Thinning - Thinning is an alternative for stands capable of responding to release. It should also be confined to stands with a dwarf mistletoe rating (DMR) of 3.0 or less (at age 100) (Hawksworth 1961). The amount of dwarf mistletoe infection allowed in stands of various ages is presented in Figure 4. If the infection exceeds the allowable level at a given age, the stand should not be thinned. Remaining crop trees generally increase in vigor and growth. Although released trees may reach the high risk diameter sooner than unthinned stands, healthy trees tend to "pitchout" attacking beetles.

Vigorously growing trees are just as susceptible to dwarf mistletoe infection as stagnant trees. If mistletoe is present in a stand scheduled to be thinned, trees containing mistletoe should be felled and the understory sanitized.

3. Thinning from above - Thinning from above reduces the threat of a large MPB infestation by removing the older and larger diameter trees; the initial food source in the stand for invading beetles. The average age and average diameter of the remaining stand should be below 80 years and 8". All dwarf mistletoe infected trees in the overstory should be removed and the understory sanitized.

4. Patch clearcuts - Small patch clearcuts, of less than 20 acres, diversify the age and diameter classes of a stand. In time, MPB outbreaks will be confined to small patches of lodgepole pine. The threat of a full stand epidemic will be substantially reduced. However, in a stand with dwarf mistletoe, this method would perpetuate dwarf mistletoe infections throughout the stand. Seeds from dwarf mistletoe infected trees would spread to the regeneration in adjacent patches and the disease would intensify with time. Therefore, this method should be confined to mistletoe-free stands.

5. Large clearcuts (20-40 acres) - Large clearcuts immediately remove MPB infestations and eliminate the risk of another MPB infestation for approximately 80 years. Clearcuts over 20 acres are also the best cutting practice for preventing dwarf mistletoe infection in the regeneration. Because dwarf mistletoe seeds travel up to one-half chain, the perimeter of infected stands adjoining mistletoe-free stands will be minimized by larger

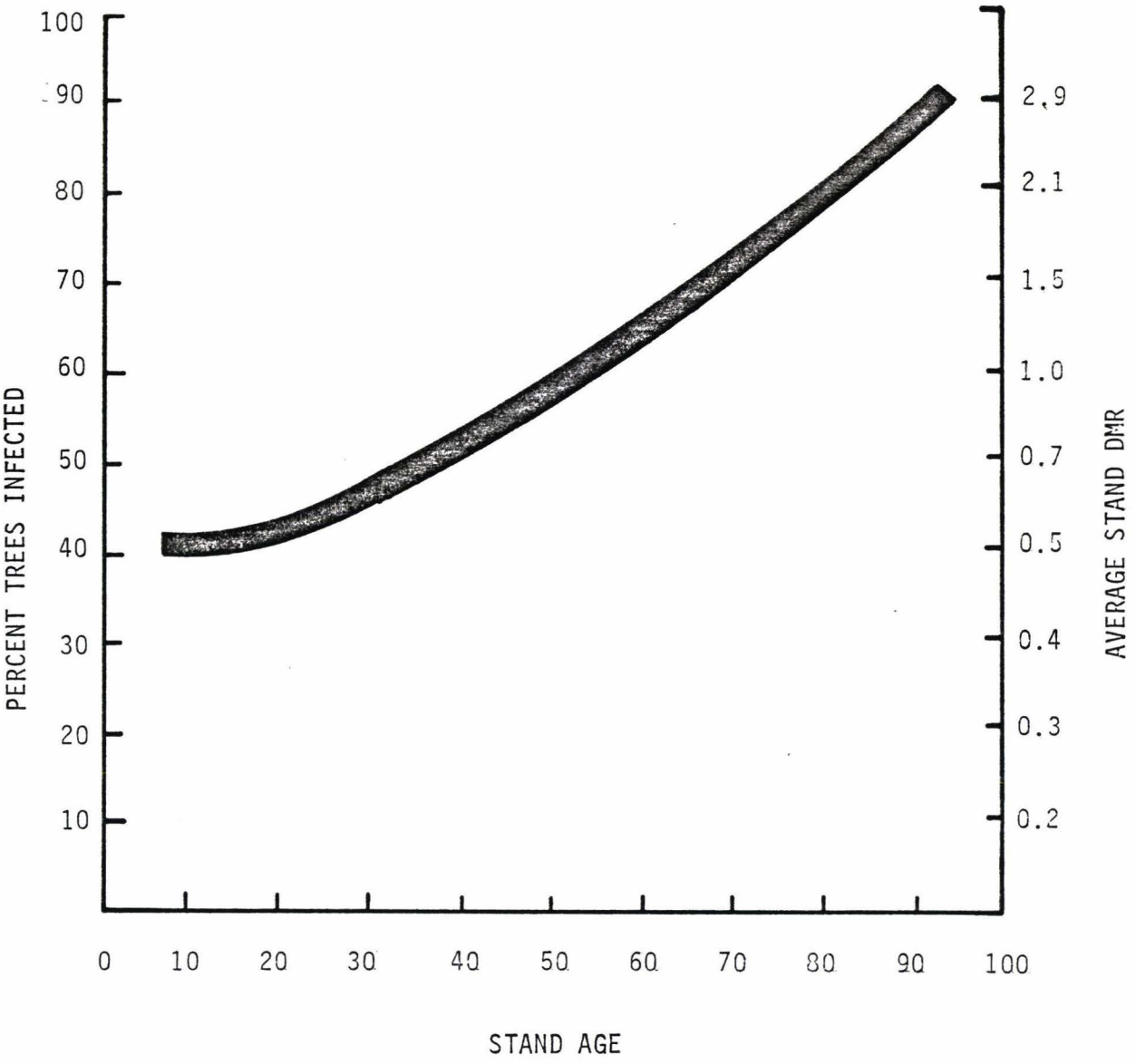

Figure 4. Maximum level of dwarf mistletoe infection allowed in proposed lodgepole pine intermediate cuttings. *

* Johnson, D. W. and F. G. Hawksworth. 1978. An evaluation survey procedure for proposed thinning projects in lodgepole pine stands infested with dwarf mistletoe.

harvest units. The boundaries of the clearcut should be placed against non-susceptible timber types, natural or man-made barriers to prevent dwarf mistletoe invasion into the disease-free unit.

SUMMARY

The moderate risk stands in Compartment 1 would benefit from immediate cuttings to reduce losses to MPB. All but one of these stands (Stand 18) contain some level of dwarf mistletoe. Immediate action should include choosing one or a combination of the management alternatives listed above to remove currently infested trees and reduce ages and diameters to prevent an ongoing infestation. When MPB is under control, ages and diameters of the trees should be kept below high-risk levels at the same time reducing dwarf mistletoe (Appendix II). Management of mistletoe-free stands should include creating a mosaic of stand age and diameter classes using a combination of the management alternatives. This will reduce the susceptibility of these stands to MPB outbreaks in the future.

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APPENDIX I. Stage II Data for Compartment 1 *

Stand No.	Acres	Growing Stock Trees/Acre	Average d.b.h. (inches)			% of Trees > 9" d.b.h.	Year of Origin of Stand	Site Index		Mistletoe Trees Per Acre	% Lodgepole > 4.9" with Mistletoe
			Overstory	Understory	Total			50	100		
1	143.4	583	6.9	1.4	7.6	13	1882	36	56	170	47
2	17.4	1123	4.2	1.3	3.0	1	1918	37	57	240	0
3	72.9	573	6.3	5.1	7.1	8	1879	40	62	198	39
4	211.3	441	8.0	1.0	8.2	19	1914	43	67	52	21
7	48.6	339	7.8	.5	9.1	20	1887	34	52	38	24
10	121.6	369	8.1	.5	8.1	37	1891	39	60	97	26
11	66.4	428	8.9	.7	8.9	17	1895	31	47	70	41
15	24.9	718	7.5	.5	7.5	13	1922	34	52	0	0
18	26.6	792	6.3	.7	7.8	6	1893	35	53	0	0
20	144.8	730	6.1	.7	7.0	7	1920	42	64	42	12
21	222.3	843	5.4	1.1	6.9	4	1916	39	60	94	23
22	183.9	558	7.8	.8	8.2	19	1884	43	67	192	59
23	71.9	1165	4.9	.6	7.0	5	1915	43	67	64	9
24	407.4	525	7.6	1.3	8.0	17	1879	42	66	142	49
30	23.8	484	7.7	0	7.7	12	1887	38	60	400	83
33	33.3	910	5.0	0	5.8	0	1921	39	59	54	10
39	183	598	4.4	5.2	7.4	6	1918	37	57	0	0

* Collected by Bureau of Land Management

APPENDIX II. Compartment 1 - Management strategies recommended to reduce dwarf mistletoe losses.

Stand No.	Current DMR 1/	DMR 1 at rotation age 2		Recommendations
		No Entries	Thinnings 3/	
1	0.7	1.3	-	Carry to rotation - clearcut
2	0	0	0	Immediate thinning to increase yields
3	0.5	1.0	-	Carry to rotation - clearcut
4	0.3	2.0	0.1	Intermediate cut, then carry to rotation - clearcut
7	0.3	1.0	-	Carry to rotation - clearcut
10	0.3	1.1	0.1	Carry to rotation - clearcut
11	0.5	1.8	0.2	Carry to rotation - clearcut
15	0	0	0	- - -
18	0	0	0	- - -
20	0.2	2.6	0.1	Immediate thinning or carry to rotation - clearcut
21	0.3	2.4	0.2	Carry to rotation - clearcut
22	1.0	2.0	-	Carry to rotation - clearcut
23*	0.2	1.9	0.8	Immediate thinning to increase yields at rotation - clearcut
24	0.7	1.3	-	Carry to rotation - clearcut
30	2.3	4.4	-	Schedule for early clearcut
33	0.2	2.6	1.1	Immediate thinning to improve vigor at rotation - clearcut
39	0	0	0	- - -

1/ DMR determined by RMYLD based on % stand infected.

2/ Rotation age is 120 years.

3/ All thinnings are made from above.

* Average stand diameter from Stage II was unrealistic; used average d.b.h. of overstory trees.